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ORIGINAL ARTICLE

Two new species of the genus *Libnotes* Westwood (Diptera: Limoniidae) from China, with a key to Chinese species

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Abstract Two new species of the genus *Libnotes* Westwood, 1876, *L. (Libnotes) wanensis* **sp. nov.** and *L. (L.) pseudonohirai* **sp. nov.** from Southern China (Anhui) are described and illustrated here. A key to all of Chinese species in the subgenus *Libnotes (Libnotes)* is provided. The type specimens of the new species are deposited in the animal specimen room, School of Life Sciences, Anqing Normal University, Anhui Province, China.

Key words Nematocera, Tipuloidea, Limoniidae, *Libnotes*, new species.

1 Introduction

The *Libnotes* is a large subgenus of the genus *Libnotes* Westwood, 1876. It is characterized by the following features: the body slender; eyes spherical, occupying almost the whole of the head; antennae short, slender, 14 segmented, gradually tapered; thorax compressed; abdomen short, abdominal segments two times longer than the breadth; wing elongate, narrow, veins in the apical part of wing simple and parallel, anal veins slender, curved toward the base; hypopygium with inner gonostylus equipped with a blade, which bears long thick bristles at apex (Westwood, 1876; Savchenko & Kirvolutskaya, 1976). Eight subgenera are recognized within the genus *Libnotes*, *Libnotes* Westwood, 1876, *Goniodineura* van der Wulp, 1895, *Laosa* Edwards, 1926, *Gressittomyia* Alexander, 1936, *Afrolimonia* Alexander, 1965, *Metalibnotes* Alexander, 1972, *Neolibnotes* Alexander, 1972, and *Paralibnotes* Alexander, 1972. The subgenus *Libnotes* differs from *Afrolimonia*, *Gressittomyia*, *Goniodineura*, *Metalibnotes*, *Paralibnotes* by the branching point of Sc distinctly beyond fork of Rs, differs from *Laosa* by the wing lacking cross-veins in apical radial cells, and differs from *Neolibnotes* by the Rs relatively long.

Up to now, 139 species and 6 subspecies in the subgenus have been reported worldwide. The majority of the species have large Oriental or Australian Ranges, with 75 and 52 species recorded, respectively. There are only 1 species from African Region, 7 species from Palaearctic Region, 6 species from both Oriental and Australian Regions, and 4 species widely distributed in both Palaearctic and Oriental Regions (Oosterbroek, 2014).

The fauna of the subgenus *Libnotes* of China remains inadequately studied, only 6 species from Chinese mainland and 5 species from Taiwan Island have been recorded so far (Alexander, 1921, 1923, 1930, 1934, 1935, 1936, 1943, 1949; Edwards, 1916). During a study of specimens collected from Yaoluoping National Nature Reserve, Anhui Province, China, two new species of subgenus *Libnotes* were found. This is the first report of subgenus *Libnotes* distributed in Anhui Province, China.

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2 Materials and methods

The specimens examined in this study were collected from Yaoluoping National Nature Reserve, Anhui Province by the author and undergraduates of School of Life Sciences, Anqing Normal University. The genital segments of the dry specimens were removed and soaked in 10% NaOH overnight. Observation and drawings were performed in glycerin jelly using a Leica MZ125 (Leica, Germany) stereomicroscope. All measurements are in millimeters (mm), made with the aid of a digital caliper. The terminology and methods of description and illustration follow that of Alexander and Byers (1981), and Ribeiro (2006).

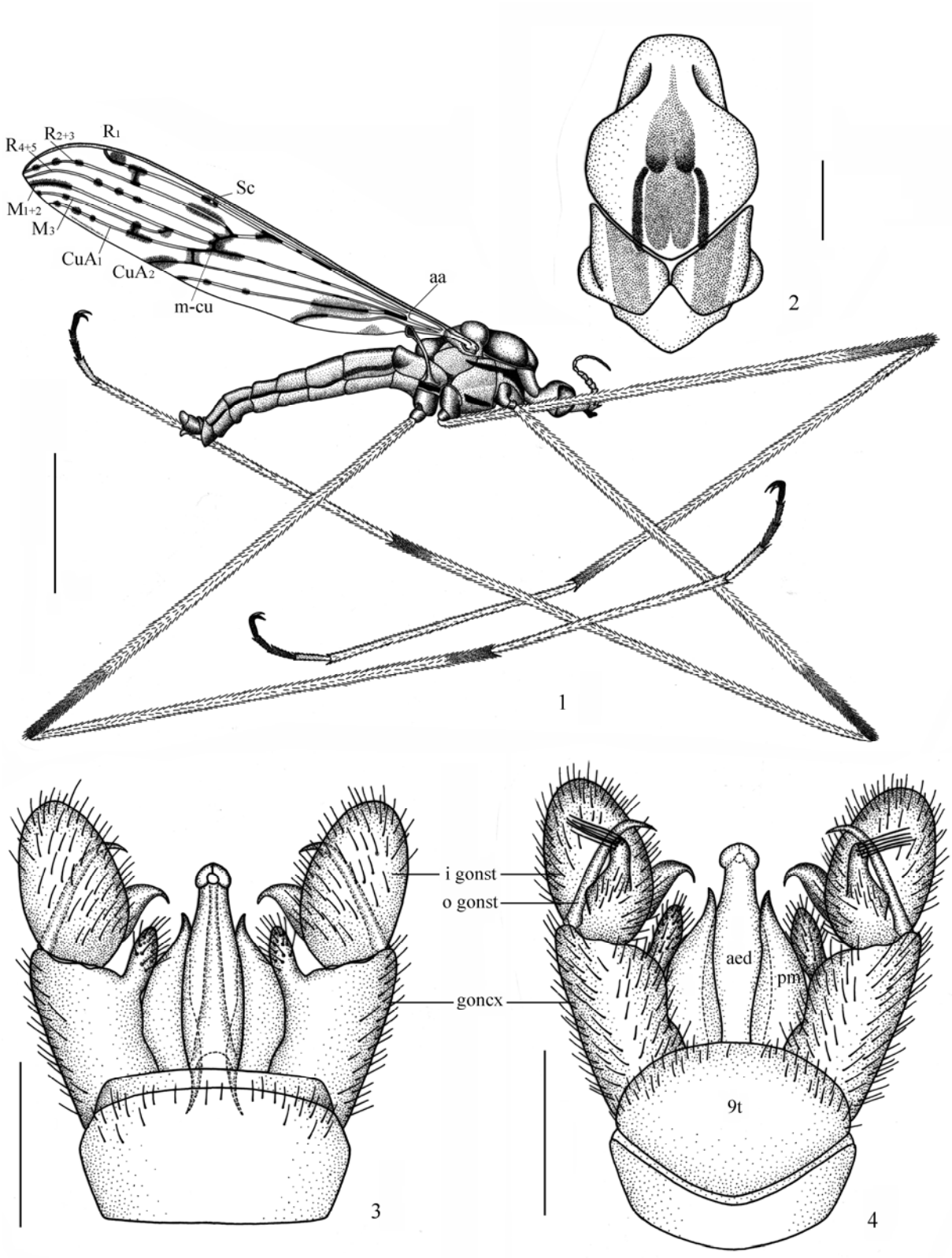
3 Taxonomy

Libnotes (*Libnotes*) Westwood, 1876

Libnotes (Libnotes) Westwood, 1876. *Trans. R. Ent. Soc. London*, 1876: 505. Type species: *Libnotes thwaitesiana* Westwood, 1876, by monotypy.

Key to the Chinese species of the subgenus *Libnotes*

1. Pleura variegated by blackened or infuscated areas 3
   Pleura without blackened or infuscated areas 2
2. Prescutum unmarked 4
   Prescutum with stripes 5
3. Abdominal tergite with median stripe 6
   Abdominal tergite without median stripe 7
4. Abdomen orange-yellow, the lateral line narrowly infused; hypopygium dark brown (Alexander, 1923: 468) ..... ***L. (L.) subopaca* Alexander, 1923** (China: Taiwan)
   Abdomen entirely light yellow; hypopygium entirely light yellow (Alexander, 1934: 41) ..... ***L. (L.) basistrigata* (Alexander, 1934)** (China: Fujian)
5. Prescutum with one median stripe (Alexander, 1930: 61) ..... ***L. (L.) recurvinervis* (Alexander, 1930)** (China: Sichuan)
   Prescutum with at least two stripes 8
6. Prescutum with four reddish-brown stripes; femora with tip yellow (Alexander, 1949: 529) ..... ***L. (L.) apitata* (Alexander, 1949)** (China: Fujian)
   Prescutum without stripe; femora with tip darkened (Alexander, 1921: 180) ..... ***L. (L.) longistigma* Alexander, 1921** (China: Taiwan; Japan, Russia)
7. Antennae uniformly colored 9
   Antennae with scape black, flagellum light brown or brown 10
8. Antennae black throughout; abdomen brownish-black throughout (Alexander, 1934: 42) ..... ***L. (L.) griseola* (Alexander, 1934)** (China: Taiwan)
   Antennae brown throughout; abdomen festucine-yellow with tergites narrowly pale in lateral margins (Fig. 5) ..... ***L. (L.) pseudonohirai* sp. nov.**
9. Femora with subterminal ring 11
   Femora without subterminal ring (Alexander, 1936: 123) ..... ***L. (L.) quinquecostata* (Alexander, 1936)** (China: Hainan)
10. Femora with subterminal ring 12
    Femora without subterminal ring (Fig. 1) ..... ***L. (L.) wanensis* sp. nov.**
11. Pleura with a black dot beneath the root of the wing; prescutum without stripe (Edwards, 1916: 355) ..... ***L. (L.) limpid* Edwards, 1916** (China: Taiwan; Malaysia)
    Pleura without black dot; prescutum with a pair of stripes (Alexander, 1935: 141) ..... ***L. (L.) comissabunda* (Alexander, 1935)** (China: Taiwan)
12. Pleura with one narrow brownish-black stripe (Alexander, 1943: 175) ..... ***L. (L.) sappho* (Alexander, 1943)** (China: Guangdong)
    Pleura with two narrow dark brown stripes (Alexander, 1949: 530) ..... ***L. (L.) tszi* (Alexander, 1949)** (China: Guangdong)



Figs 1–4. *Libnotes (Libnotes) wanensis* **sp. nov.** 1. Habitus of male adult, lateral view. 2. Thorax, dorsal view. 3. Hypopygium, ventral view. 4. Hypopygium, dorsal view. Abbreviations: aa, anterior arculus; aed, aedeagus; goncx, gonocoxite; i gonst, inner gonostylus; o gonst, outer gonostylus; pm, paramere. Scale bars: 1 = 5.0 mm, 2= 1.0 mm, 3–4 = 0.5 mm.

***Libnotes (Libnotes) wanensis* sp. nov.** (Figs 1–4)

Length. Body, male 9.8–10.0 mm (*n*=2). Wing, male 16.3–16.5 mm (*n*=2).

Rostrum black throughout, relatively short, about equal in length to head; palpi black; eyes black; antennae with scape black and elongate, four to five times longer than pedicel, cylindrical, pedicel black and spherical, flagellum light brown with flagellomeres one to five spherical, gradually smaller, remainder of flagellomeres cylindrical. Head light brown.

Pronotum light brown. Prescutum with ground color festucine-yellow, patterned with a broad median stripe, almost extending entire length of prescutum, lateral borders of median stripe with a pair of lateral stripes, black and extending to mid-length of prescutum (Fig. 2); scutal lobes light brown, with a pale stripe in middle; scutellum yellow; postnotum black. Pleura festucine-yellow, with a narrow black longitudinal stripe extending from propleura dorsad to wing-root, with a narrow black stripe on mesepisternum (Fig. 1). Halteres with stem brown, knob black. Legs with coxae and trochanters yellow; femora festucine-yellow, tips black; tibiae pale yellow, tips narrowly black; tarsi pale brown (Fig. 1). Wings suffused with ground color pale yellow, a series of patterns along veins: Sc with a spot at tip, R_1 with a spot at same level of spot on Sc, with another two spots near apex, Rs with pattern at origin, R_{2+3} and R_{4+5} respectively with three spots along veins at apical part, M_{1+2} with a stripe along vein near tip, remainder of marks illustrated as Fig. 1. Veins pale yellow, black in clouded areas (Fig. 1). Venation: Rs unusually straight and oblique, Sc ending beyond fork of Rs, R_{2+3} slightly longer than R_{4+5}, R_{2+3} parallel to R_{4+5}, M_{1+2}, M_3 and CuA_1 at apical part (Fig. 1).

Abdominal segments festucine-yellow, lateral margins of tergites very narrowly pale (Fig. 1). Hypopygium ochreous-yellow. Male hypopygium with ninth tergite broad, rounded at caudal margin (Fig. 4). Gonocoxite narrow, approximately as long as inner gonostylus, with ventromesal lobe slender and finger-shaped (Figs 3–4). Inner gonostylus very large, oval, a pale lobe on surface near base, tip of lobe with a wisp of long setae, rostral prolongation relatively slender, terminating into a curved spine (Figs 3–4). Outer gonostylus hook-shaped, curved at end, uniformly thick except slightly expanded base (Figs 3–4). Paramere with mesal-apical lobe slender and curved (Figs 3–4). Aedeagus relatively thick, expanded and bifid at apex (Figs 3–4).

Remarks. This new species is similar to another Chinese species *L. (L.) tszi* (Alexander, 1949) by the presence of two stripes on pleura, and by the colorations of the antennae and abdomen. It can be easily distinguished from the latter by the femora festucine-yellow, without subterminal ring as shown in Fig. 1 (femora yellow, all with a pale brown subterminal ring that is from 3 to 4 times as broad as the yellow tip in *L. (L.) tszi* as described by Alexander, 1949: 531), and by the absence of band between arculus and origin of Rs as illustrated in Fig. 1 (a broad and virtually continuous subbasal brown band at near mid-distance between arculus and origin of Rs in *L. (L.) tszi* as described by Alexander, 1949: 531).

Material examined. Holotype male, China, Anhui Province, Yuexi, Yaoluoping National Nature Reserve (elev. 900 m), 14 August 2013, coll. Qiu-Lei Men. Paratype 1 male, same data as holotype, 16 August 2013.

Distribution. China (Anhui).

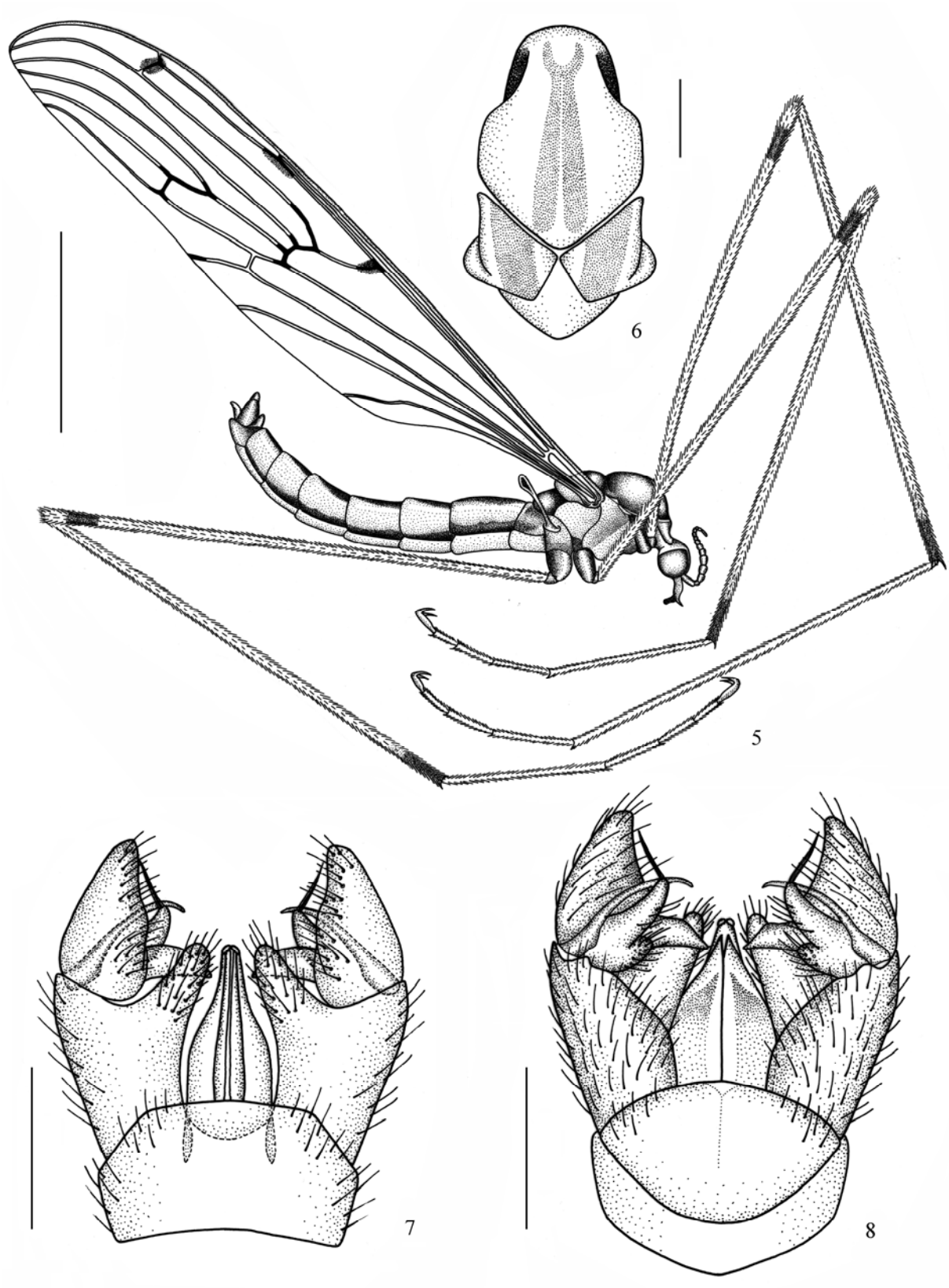
Etymology. The specific epithet is a noun '*wan*', the abbreviation of Anhui Province, with Latin suffix '*ensis*', referring to the distribution of new species.

***Libnotes (Libnotes) pseudonohirai* sp. nov.** (Figs 5–8)

Length. Body, male 10.6–10.8 mm (*n*=3). Wing, male 17.3–17.5 mm (*n*=3).

Rostrum dark brown, slightly shorter than head; palpi black; eyes black; antennae brown throughout, scape elongate and cylindrical, pedicel spherical, flagellum with flagellomeres one to six spherical, gradually smaller, remainder of flagellomeres slender and cylindrical. Head light brown.

Pronotum light brown, a little darker in middle. Prescutum with ground color festucine-yellow, patterned with two median stripes, almost extending entire length of prescutum, converging at apical part and forming a semicircle, humeral region tinged with black (Fig. 6); scutellum yellow; postnotum pale brown. Pleura festucine-yellow, unpatterned (Fig. 5). Halteres with stem brown, knob dark brown. Legs with coxae and trochanters yellow; femora festucine-yellow, with a pale brown subterminal ring that is as broad as yellow tip; tibiae pale yellow, tip pale brown; tarsi pale brown (Fig. 5). Wings suffused with pale yellow, Sc with a spot at tip, R_1 with a spot at same level of spot on Sc, apically with another spot, Rs



Figs 5–8. *Libnotes (Libnotes) pseudonohirai* **sp. nov.** 5. Habitus of male adult, lateral view. 6. Thorax, dorsal view. 7. Hypopygium, ventral view. 8. Hypopygium, dorsal view. Scale bars: 1 = 5.0 mm, 2= 1.0 mm, 3–4 = 0.5 mm.

with marking at origin (Fig. 5). Fork of Rs, r-m, and forks of M tinged with dark brown (Fig. 5). Venation: Rs relatively curve, Sc ending beyond fork of Rs, R_{2+3} parallel to R_{4+5}, M_{1+2}, M_3 and CuA_1 at apical part (Fig. 5).

Abdominal segments festucine-yellow, lateral margins of tergites very narrowly pale, apparent only on more proximal segments, caudal margins of segments narrowly more yellow, middle part of tergite suffused with irregular stripe (Fig. 5). Hypopygium pale yellow. Male hypopygium with ninth tergite rounded at caudal margin (Fig. 8). Gonocoxite narrow, slightly longer than inner gonostylus, with ventromesal lobe broad and elongate, almost reaching end of aedeagus (Figs 7–8). Inner gonostylus subtriangular in ventral view, a bifurcated prominence on surface at base, upper prominence long, with a wisp of long setae at apex, lower prominence short, densely covered with strong setae, rostral prolongation relatively slender (Figs 7–8). Outer gonostylus hook-shaped, curved at end, expanded at basal one-third (Figs 7–8). Paramere with mesal-apical lobes broad, straight at inner margins (Figs 7–8). Aedeagus relatively thick, bifid at apex (Figs 7–8).

Remarks. This new species is similar to a Palaearctic species *L. (L.) nohirai* Alexander, 1918 by the colorations of the antennae and thorax, and by the markings on wing and abdomen. It can be easily distinguished from the latter by the femora with a pale brown subterminal ring which is as broad as the yellow tip as shown in Fig. 5 (femora without subterminal ring, tip broadly black in *L. (L.) nohirai* as described by Alexander, 1918: 445 and illustrated at the website of CCW, Oosterbroek, 2014), by the costal and subcostal cells not bright yellow, same with ground color (costal and subcostal cells bright yellow in *L. (L.) nohirai* as described by Alexander, 1918: 445 and illustrated at the website of CCW, Oosterbroek, 2014), and by the gonocoxite with ventromesal lobe broad and elongate as illustrated in Figs 7–8 (relatively narrow in *L. (L.) nohirai* as illustrated in Podenas & Gelhaus, 2007: 66, Fig. 120. 2).

Material examined. Holotype male, China, Anhui Province, Yuexi, Yaoluoping National Nature Reserve (elev. 1000 m), 14 August 2013, coll. Qiu-Lei Men. Paratypes 2 males, China, Anhui Province, Yuexi, Yaoluoping National Nature Reserve (elev. 800 m), 17 August 2013, coll. Zheng-Kui Liu.

Distribution. China (Anhui).

Etymology. The specific epithet bases on the name of a related species, *nohirai*, with Latin prefix '*pseudo*', referring to the morphological similarity of the new species to *nohirai*.

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